



National Institute of Standards & Technology

Certificate of Analysis

Standard Reference Material[®] 2613a

Carbon Monoxide in Air

(Nominal Amount-of-Substance Fraction – 20 $\mu\text{mol/mol}$)

This certificate reports the certified value for Lot 22-XX-E.

This Standard Reference Material (SRM) is a primary gas mixture which, the amount-of-substance fraction expressed as concentration [1], may be related to secondary working standards. The SRM is intended for the calibration of instruments used for carbon monoxide determinations and for other uses.

This SRM mixture is supplied in a DOT 3AL specification aluminum (6061 alloy) cylinder with a water volume of 6 L. Mixtures are shipped with a nominal pressure exceeding 12.4 MPa (1800 psi), which provides the user with 0.73 m³ (25.8 ft³) of useable mixture. The cylinder is the property of the purchaser and is equipped with a CGA-590 brass valve, which is the recommended outlet for this carbon monoxide mixture. NIST recommends that this cylinder **NOT** be used below 0.7 MPa (100 psi).

Certified Value: This SRM mixture has been certified for carbon monoxide concentration. The certified value, given below, applies to the identified cylinder and NIST sample number.

Carbon Monoxide Concentration: 19.72 $\mu\text{mol/mol}$ \pm 0.25 $\mu\text{mol/mol}$

Cylinder Number:

NIST Sample Number:

The uncertainty of the certified value includes the estimated uncertainties in the NIST standards, the analytical comparisons to the lot standard (LS), and the uncertainty of comparing the LS with each of the mixtures comprising the lot. The uncertainty is expressed as an expanded uncertainty, $U = ku_c$ with u_c determined by experiment and a coverage factor $k = 2$. The true value for the carbon monoxide amount-of-substance is asserted to lie in the interval defined by the certified value $\pm U$ with a level of confidence of approximately 95 % [2].

Expiration of Certification: This certification is valid until **20 October 2011**, within the measurement uncertainties specified, provided the SRM is handled and stored in accordance with the instructions given in this certificate. However, the certification will be nullified if the SRM is contaminated or modified. NIST will monitor this SRM over the period of its certification. If changes occur that affect the certification before the expiration of this certificate, NIST will notify the purchaser. Registration (see attached sheet) will facilitate notification.

Hydrotest Date: 03/94

Blend date: 03/95

Cylinder and Gas Handling Information: NIST recommends the use of a high-purity, two-stage pressure regulator with a stainless steel diaphragm and CGA-590 outlet to safely reduce the pressure and to deliver this SRM mixture to the instrument. The regulator should be purged several times to prevent accidental contamination of the sample.

The analytical measurements leading to the certification of this current SRM lot were performed by W.R. Miller of the NIST Analytical Chemistry Division.

Stephen A. Wise, Chief
Analytical Chemistry Division

Gaithersburg, MD 20899
Certificate Issue Date: 13 January 2006

Robert L. Watters, Jr., Chief
Measurement Services Division

See Certificate Revision History on Last Page

The overall direction and coordination of the technical work required for certification of this SRM lot were performed by F.R. Guenther of the NIST Analytical Chemistry Division.

The support aspects involved in the issuance of this SRM were coordinated through the NIST Measurement Services Division.

Mixture Preparation: The gas mixtures comprising this SRM lot were prepared in accordance with NIST technical specifications by a commercial specialty gas vendor under contract to NIST. The specifications stipulate that each SRM mixture be identical in carbon monoxide concentration and stable with time.

Analytical Methods: Analyses of the carbon monoxide concentration for this lot of cylinders were conducted by intercomparing each cylinder mixture to a representative cylinder chosen from the lot, the lot standard (LS), using gas chromatography with a methanator and a Flame Ionization Detector (GC/Meth/FID). Assignment of the carbon monoxide concentration to the LS was accomplished by intercomparison to primary gravimetric standards using GC/Meth/FID.

Homogeneity Analysis: Each of the carbon monoxide mixtures, which comprise this SRM lot, was compared to the LS using GC/Meth/FID. An analysis of variance indicated that sample-to-sample carbon monoxide concentration differences were statistically insignificant. This indicates that within the precision of the NIST measurements, all of the cylinders comprising this SRM lot have identical carbon monoxide concentrations. Therefore, one concentration has been assigned to the entire SRM lot.

Carbon Monoxide Concentration Value Assignment: The certified carbon monoxide concentration for this SRM lot was computed from the assigned concentration for the LS and the homogeneity analysis.

Stability: Periodic analyses of SRM units from this lot are performed at NIST to monitor stability. If significant changes in the carbon monoxide concentration are observed, the purchaser will be notified. Refer to the "Cylinder and Gas Handling Information" section for proper handling of this SRM.

Other Analyses: Additional analyses performed during the certification process are given below. The amount-of-substance fractions reported are not certified values. These values are given for informational purposes only.

Constituent		Concentration	
Oxygen	21.0	% mol/mol	(as determined by mass spectrometry)
Argon	0.92	% mol/mol	(as determined by mass spectrometry)
Carbon Dioxide	<100	μmol/mol	(as determined by mass spectrometry)
Methane	0.2 – 0.3	μmol/mol	(as determined by GC/FID)

REFERENCES

- [1] Taylor, B.N.; *Guide for the Use of the International System of Units (SI)*; NIST Special Publication 811; U.S. Government Printing Office: Washington, DC (1995).
- [2] ISO; *Guide to the Expression of Uncertainty in Measurement*; ISBN 92-67-10188-9, 1st ed.; International Organization for Standardization: Geneva, Switzerland (1993); see also Taylor, B.N.; Kuyatt, C.E.; *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*; NIST Technical Note 1297; U.S. Government Printing Office: Washington, DC (1994); available at <http://physics.nist.gov/Pubs/>.

Certificate Revision History: 13 January 2006(This technical revision reports an extension of the certification period); 16 August 2001 (This technical revision reports a change in the expiration date); 14 November 1995 (Original certificate date).

Users of this SRM should ensure that the certificate in their possession is current. This can be accomplished by contacting the SRM Program at: telephone (301) 975-6776; fax (301) 926-4751; e-mail srminfo@nist.gov; or via the Internet at <http://www.nist.gov/srm>.